

ELECTRIC VEHICLE CHARGING STATION PLAN UPDATE

**Planning and Programming Committee
October 11, 2019**

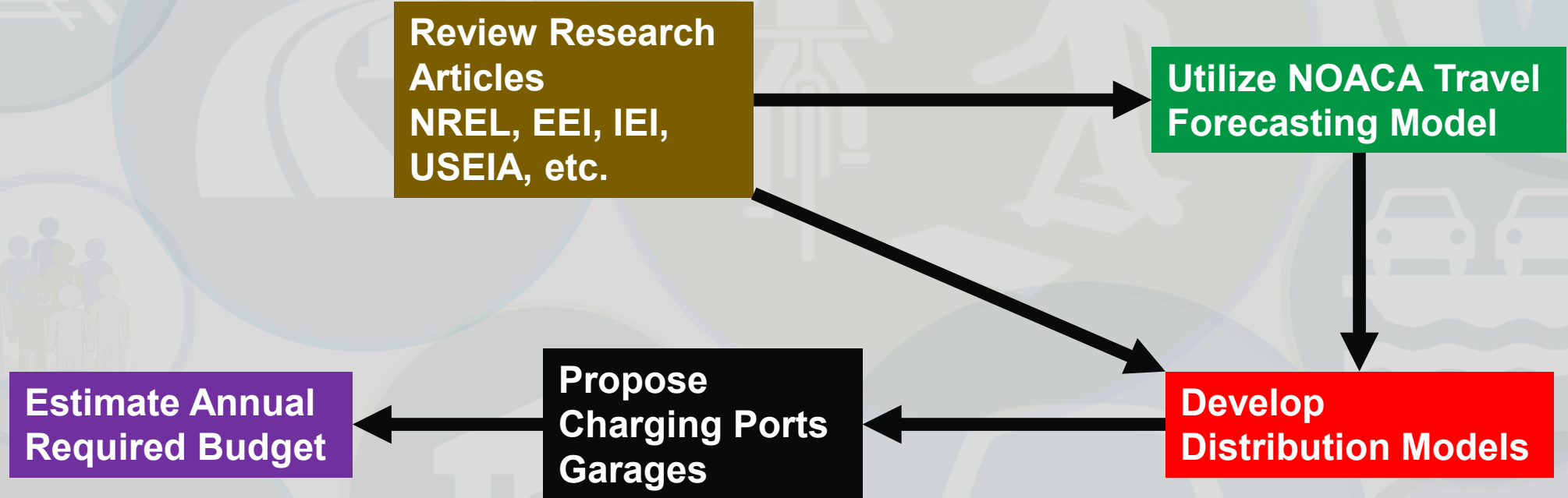
ACTION REQUESTED

No action is being requested. This item is being presented for information and discussion.

PREVIOUS ACTION

No previous actions

STUDY PROCESS



BACKGROUND

National Renewable Energy Laboratory (NREL) Charging Station Types

Charging Level	Private Location	Publicly Available
AC Level 1	Home	No
AC Level 2	Workplace / Public Parking Garages	No / Yes
DC Fast Charging (DCFC)	Public Parking Garages & Lots	Yes



BACKGROUND

Prices of Electric, Conventional and Plug-In Hybrid Vehicles

PEV Model	2018 Base Price*	Coventional Vehicle Model	2018 Base Price	Plug-In Hybrid Vehicle Model	2018 Base Price
Nissan Leaf	\$22,490	Honda Civic	\$18,840	Chevrolet Volt	\$25,720
Chevrolet Bolt	\$25,995	Toyota RAV4	\$24,510	Kia Niro	\$23,357
Tesla Model S	\$67,000	Mercedes Benz CLS Class	\$75,150	BMW 740e Xdrive iPerformance	\$86,032
Tesla Model X	\$72,000	Porsche Cayenne	\$65,700	Porsche Cayenne E-Hybrid	\$74,564

*Prices after \$7,500 federal tax credit for electric vehicles.

BACKGROUND

Electric Vehicle Purchasing Decisions

Early Adopters are generally:

- Wealthier
- More Educated
- More Comfortable with technology, and
- Have a stronger environmental attitude

..... than the rest of society

Source : The US Department of Energy's Vehicle Technologies Office, 2018

BACKGROUND

Charging Level	Location	Charging Time	Vehicle Range Added (Mile)	Power Rate (kw)	Supply Power
AC Level 1	Residential	One Hour	4	1.4	120VAC/20A (12-16A continuous)
			6	1.9	
AC Level 2	Workplace & Public Parking Garages	One Hour	10	3.4	208/240VAC/20-100A (16-80A continuous)
			20	6.6	
			60	19.2	
DC Fast Charging (DCFC)	Public Parking Garages & Lots	20 Minutes	24	24	240/480VAC 3-phase (input current proportional to output power; ~20-400A AC)
			50	50	
			90	90	

BACKGROUND

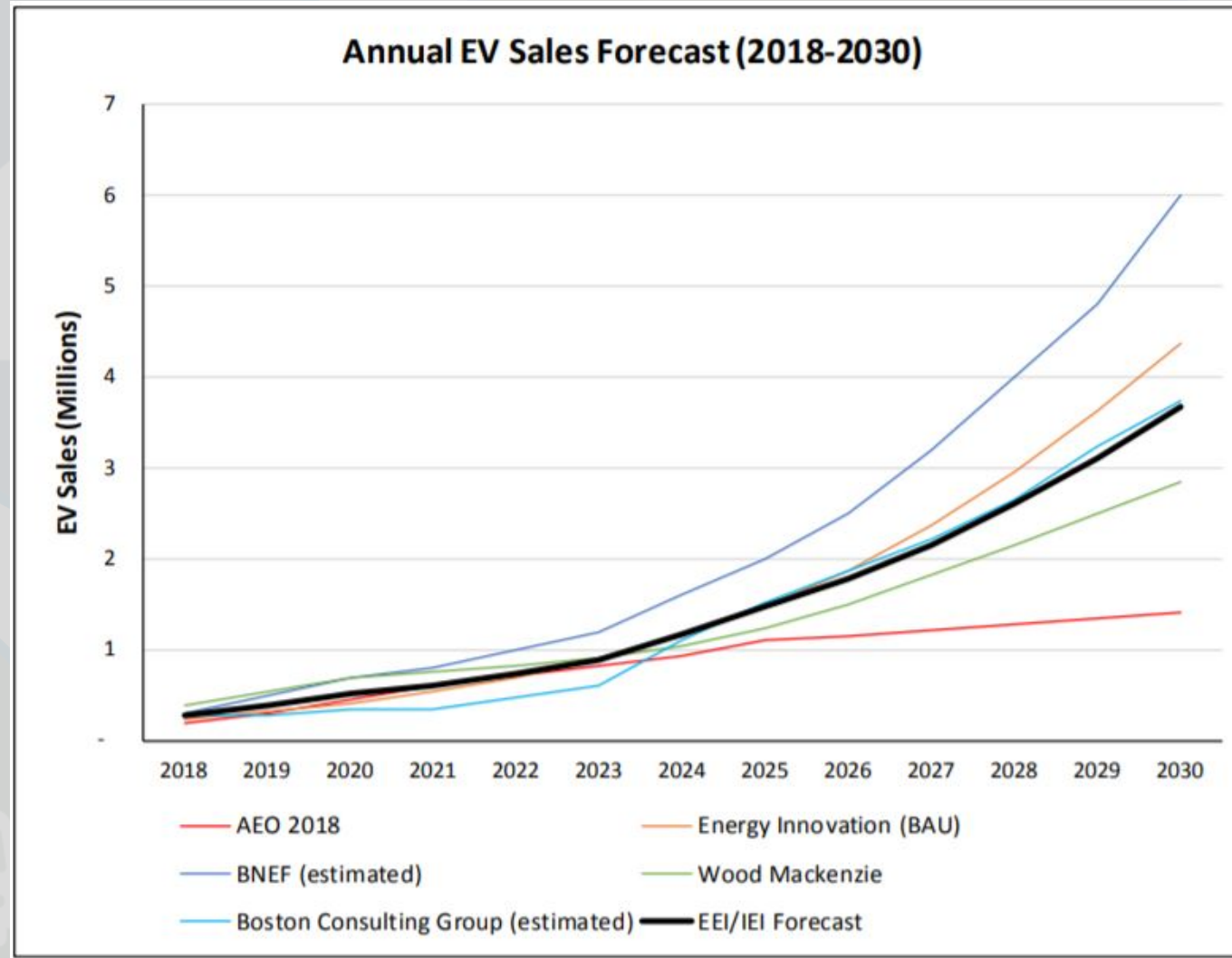
Electric Vehicle Forecast

Independent forecasts:

- **Bloomberg New Energy Finance (BNEF): Electric Vehicle Outlook 2018 (May 2018)**
- **Boston Consulting Group (BCG): The Electric Car Tipping Point (Nov. 2017)**
- **Energy Innovation: Energy Policy Simulator 1.4.1 (July 2018)**
- **US Energy Information Administration (EIA) : Annual Energy Outlook 2018 Reference Case(Feb. 2018)**
- **Wood Mackenzie: The Electric Vehicle Outlook Data (Aug. 2018)**
- **Edison Electric Institute (EEI) & Institute for Electric Innovation (IEI) (Nov. 2018)**



ANNUAL EV SALES FORECAST

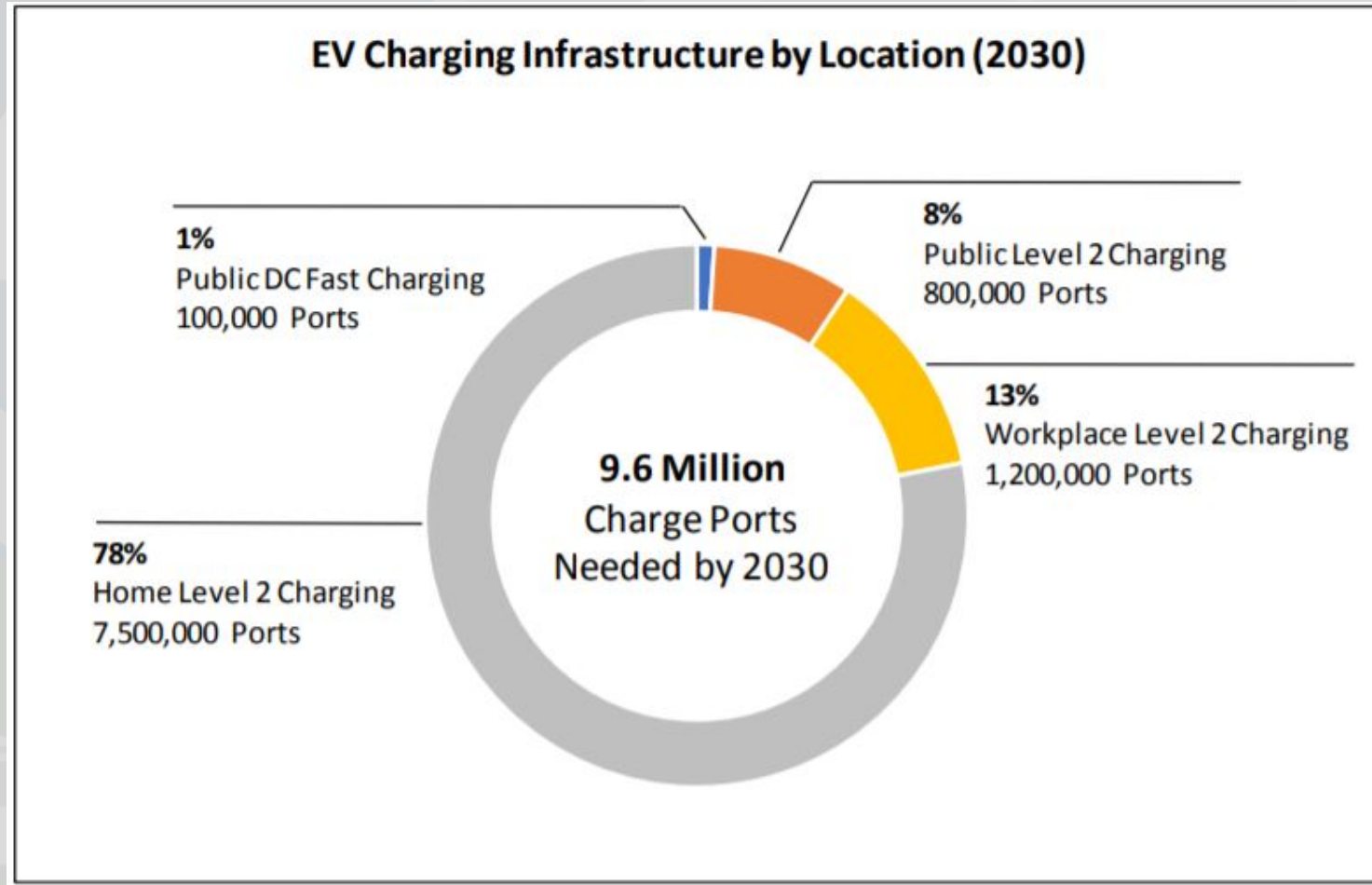


BACKGROUND

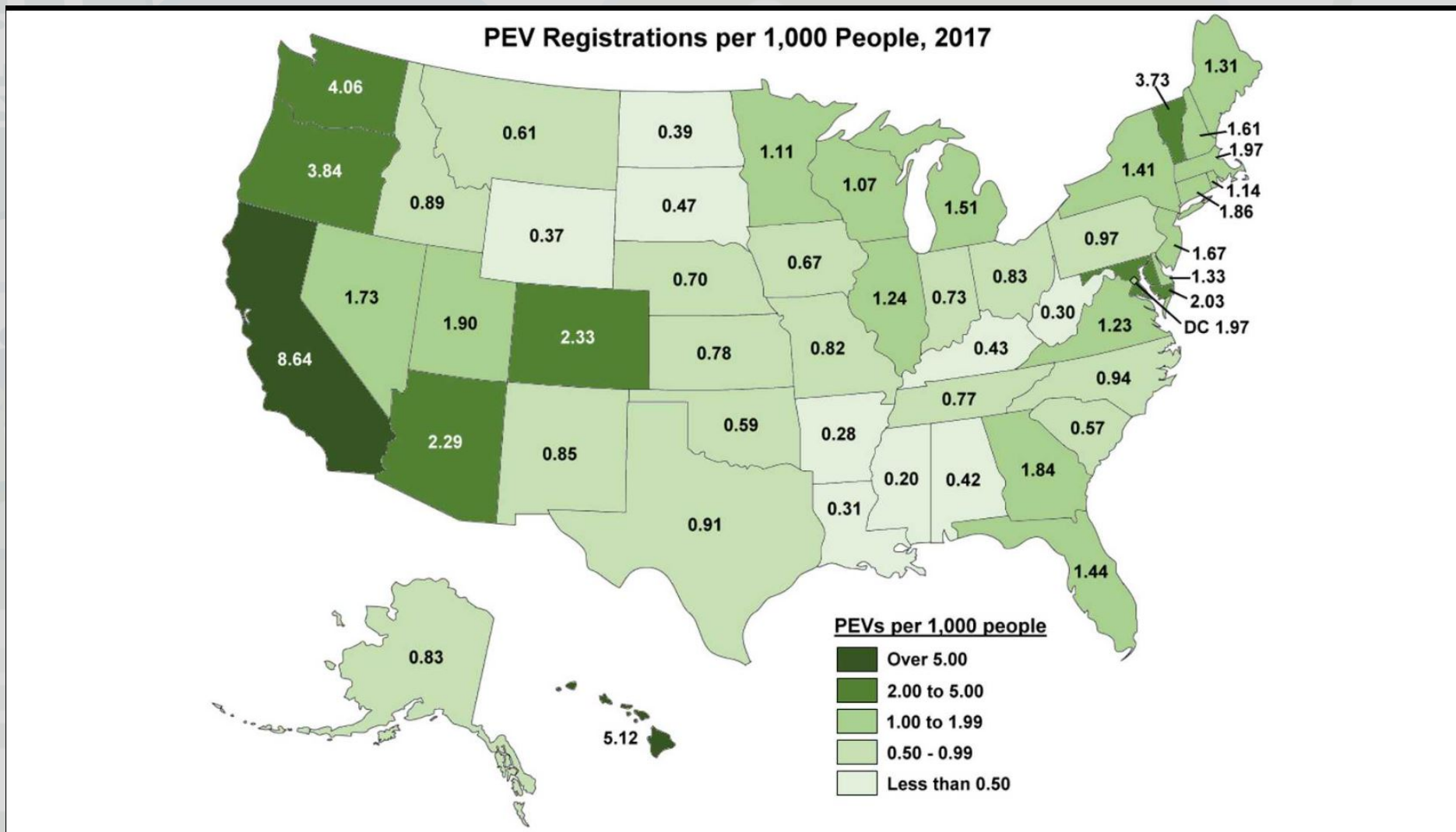
Existing & Projected number of EVs on U.S. roads:

- At the end of 2018 : Slightly over 1 million EVs
- In 2030: 18.7 million EVs: 7 percent of the 259 million vehicles (cars & light trucks)
- Annual sales of EVs in 2030: will Exceed 3.5 million (more than 20 percent of annual vehicle sales)
- About 9.6 million charge port will be required to support 18.7 million EVs in 2030.

EV CHARGING INFRASTRUCTURE BY LOCATION BASED ON EEI/IEI FORECAST

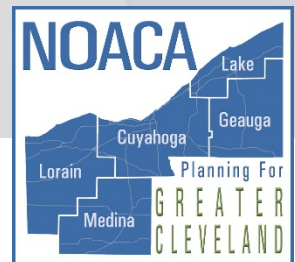


PLUG-IN ELECTRIC VEHICLE (PEV)



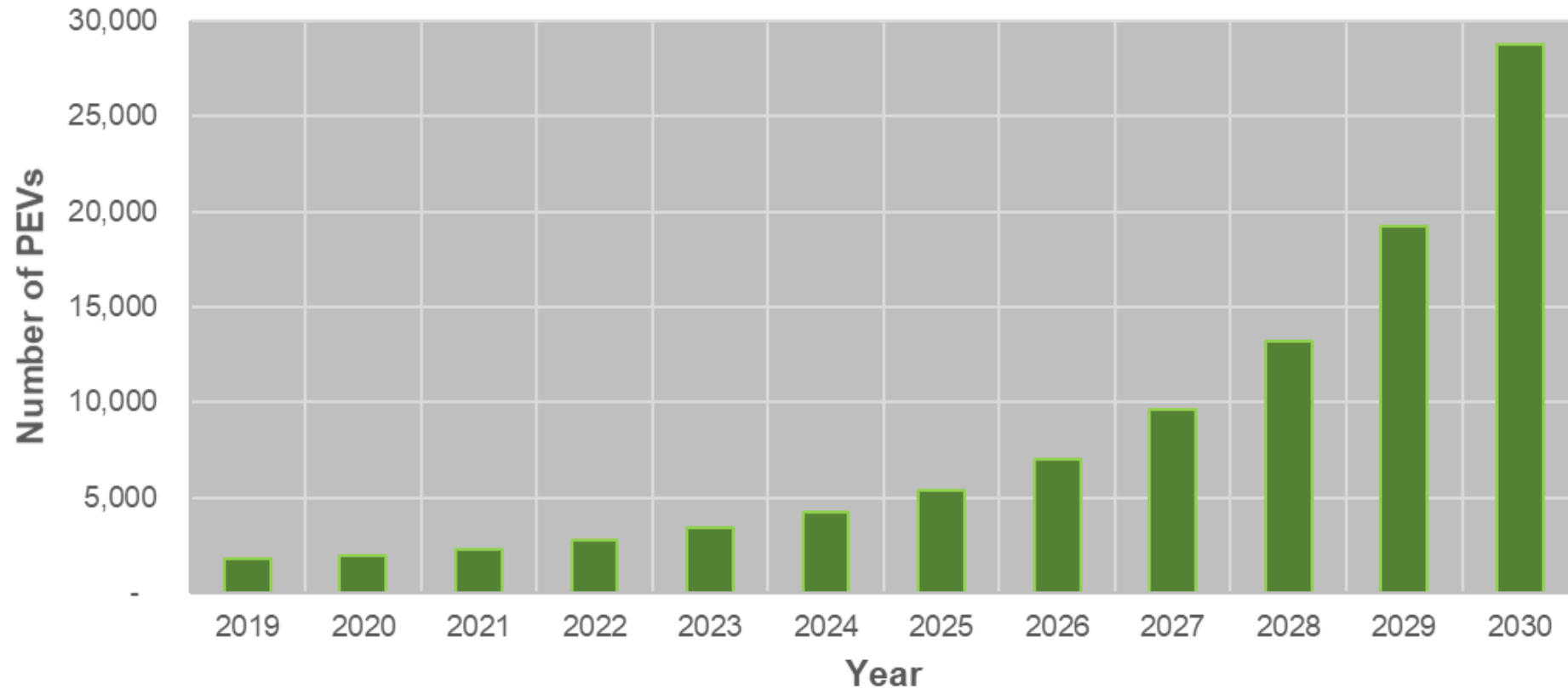
NOACA REGION PEV INFORMATION

- **Plug-in Electric Vehicle (PEV)**
- **Estimated Existing PEVs in the NOACA region: 1,600**
- **Estimated PEVs in Cleveland: 1,400 (as of the end 2016)**
- **Households paid an average of 10 - 13.4 cents per kWh of electricity in 2017.**
- **For 15,000 VMT in a year, charging a PEV costs \$540 (4,500 kWh and 3.6 cents per mile).**
- **Conventional Vehicle fuels costs 11.3 cents per mile.**
- **(22.9 MPG & \$2.6 per Gallon)**



ANNUAL FORECAST

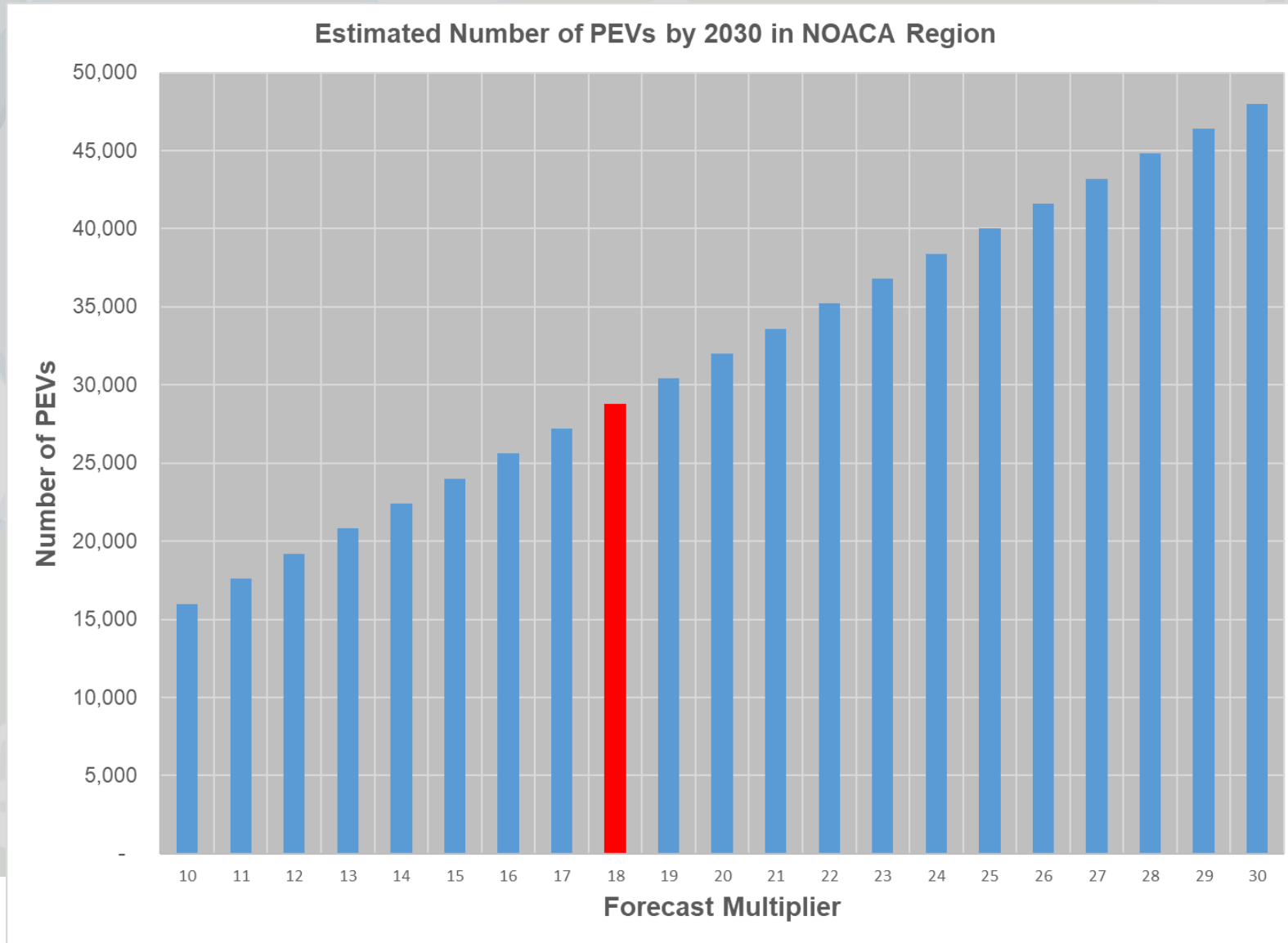
Estimated Number of PEVs in NOACA Region



SENSITIVITY ANALYSIS

NOACA Region			
Estimation Level	Number of PEVs by 2030	CAGR	Forecast Multiplier (2018 - 2030)
Low	16,000	21.15%	10
Moderate	28,800	27.23%	18
High	48,000	32.77%	30

SENSITIVITY ANALYSIS



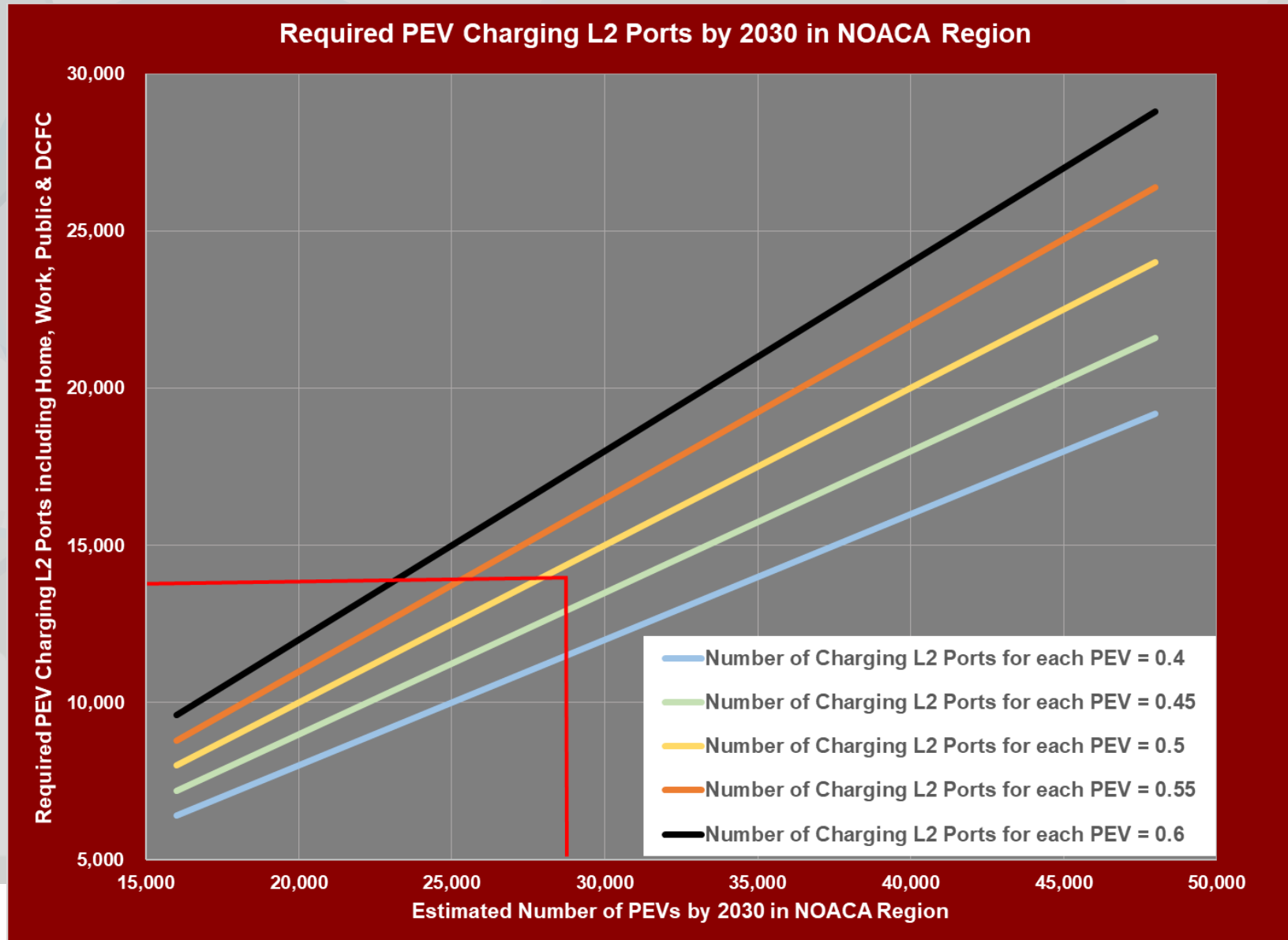
ESTIMATED REQUIRED CHARGING PORTS

Charging Level	Required Ports		Proposed
	EEI / IEI	U.S. Department of Energy - Energy Efficiency & Renewable Energy	
Home Level 2	11,532		12,000
Public Level 2	1,182	453	800
Workplace Level 2	1,922	675	1,300
Public DCFC	148	86	120

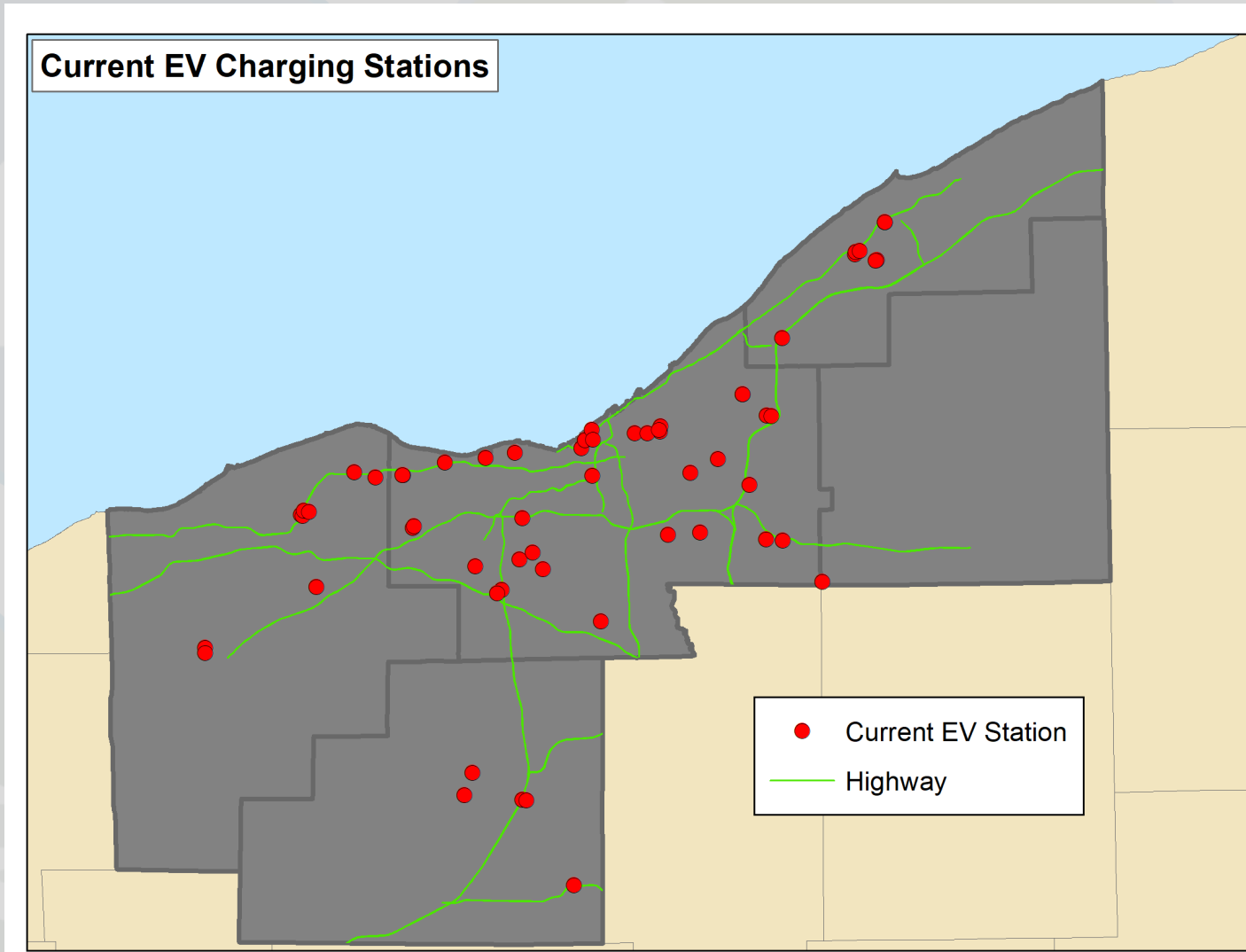
SENSITIVITY ANALYSIS

NOACA Region				
Required EV Charging Ports				
Estimation Level	Home Level 2	Public Level 2	Workplace Level 2	Public DCFC
Low	4,992	512	832	64
Moderate	12,000	800	1,300	120
High	22,464	2,304	3,744	288

SENSITIVITY ANALYSIS



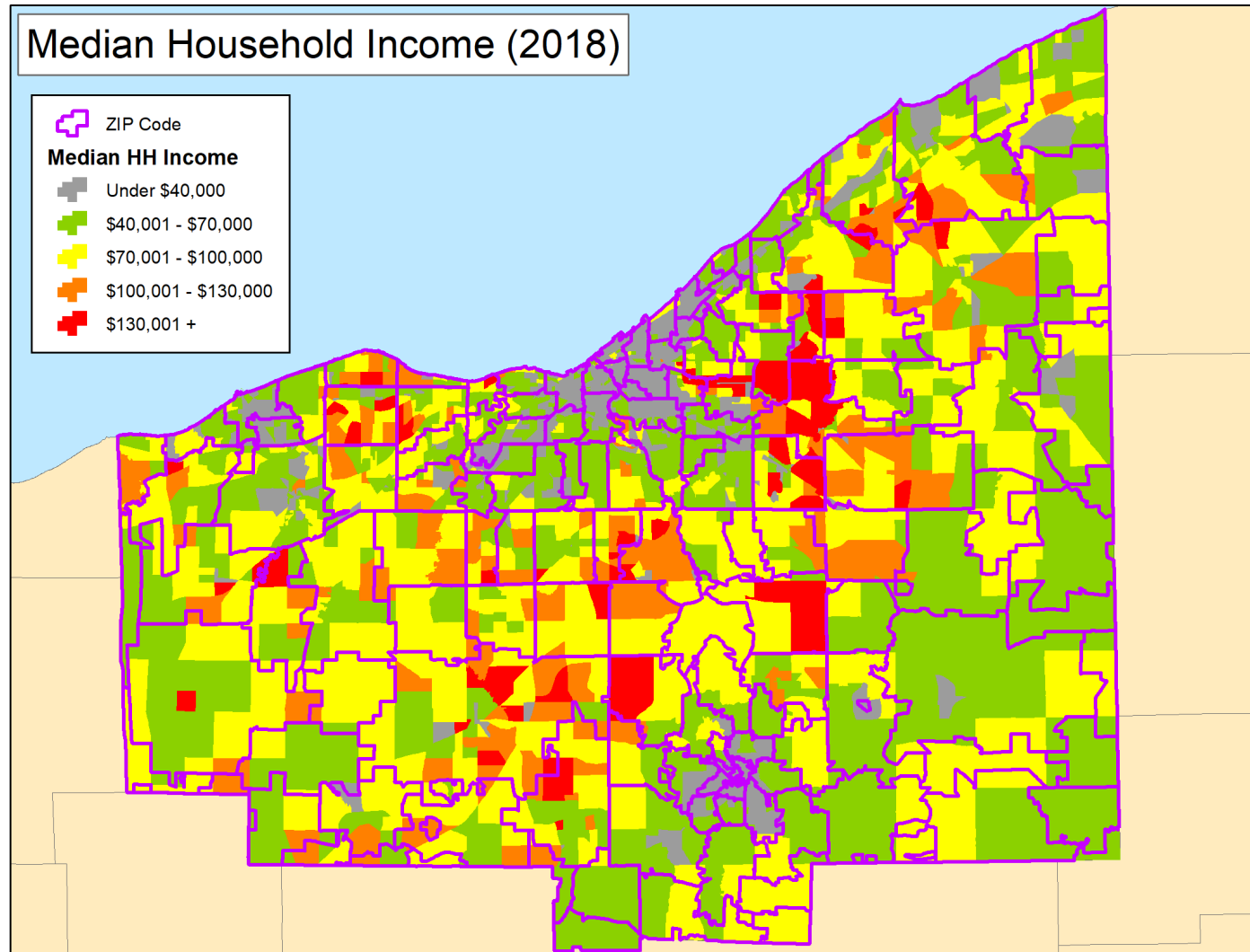
EXISTING EV CHARGING STATIONS



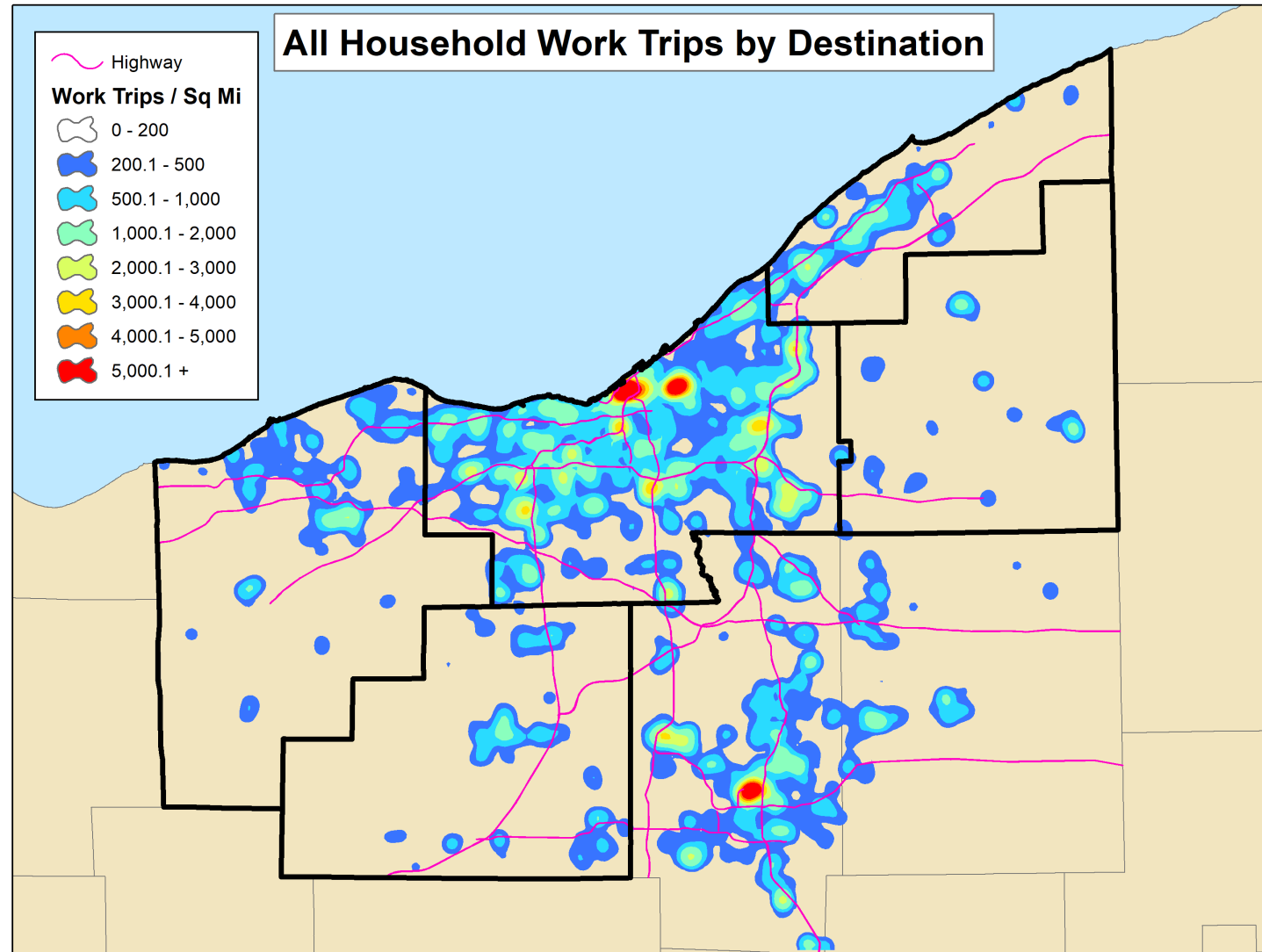
PROPOSED WORKPLACE OUTLETS



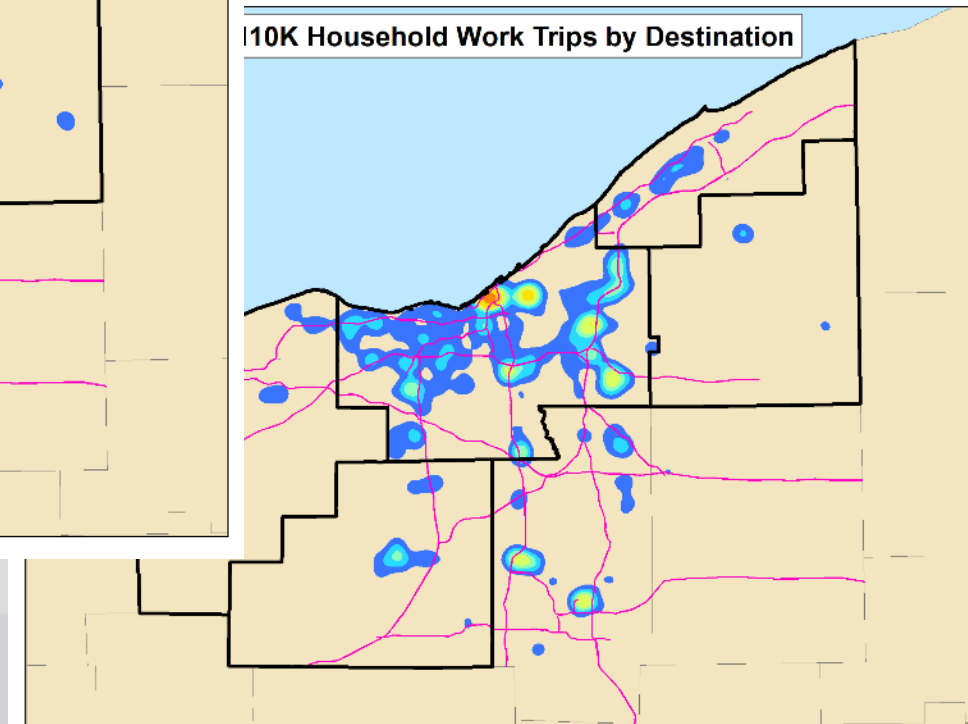
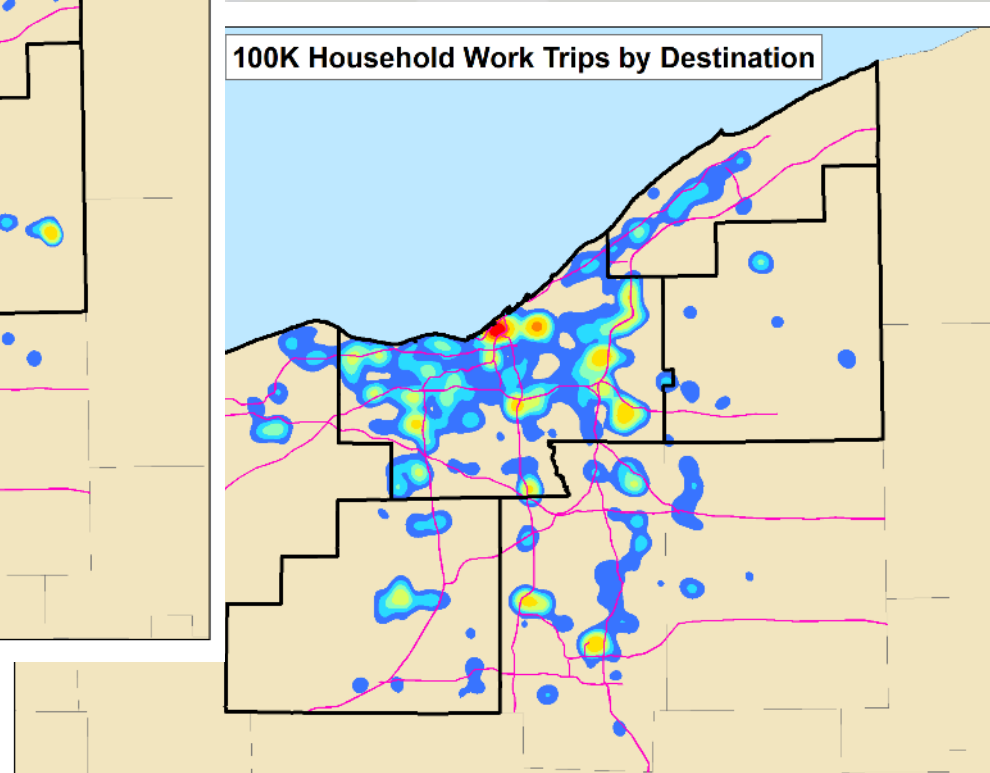
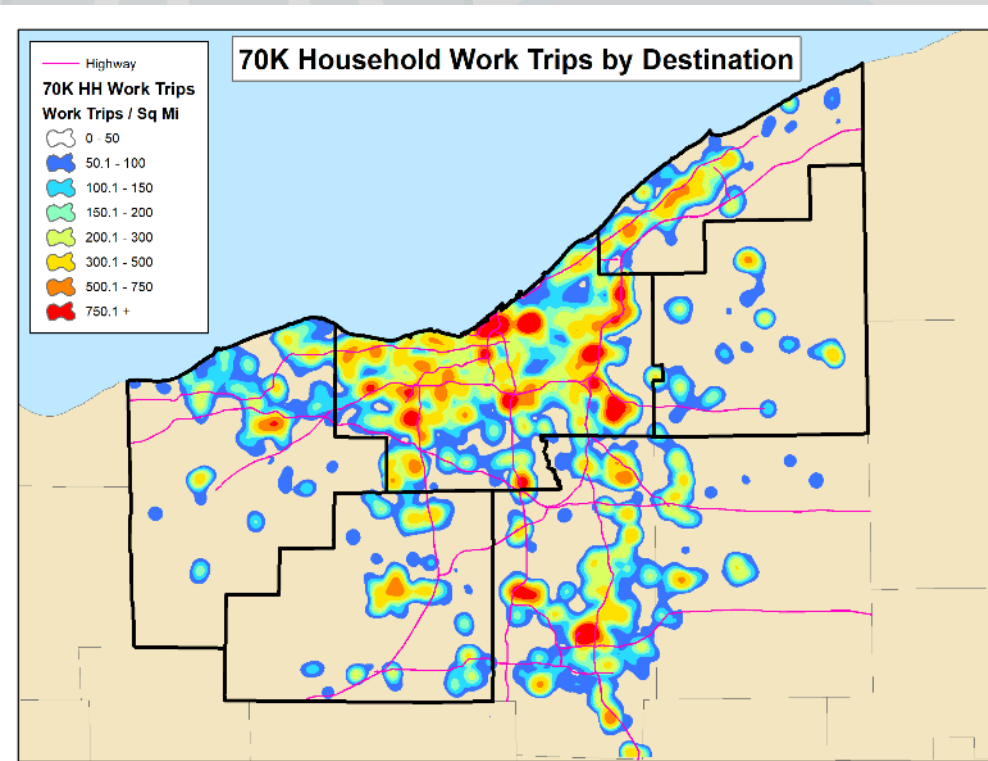
MEDIAN HOUSEHOLD INCOME (2018)



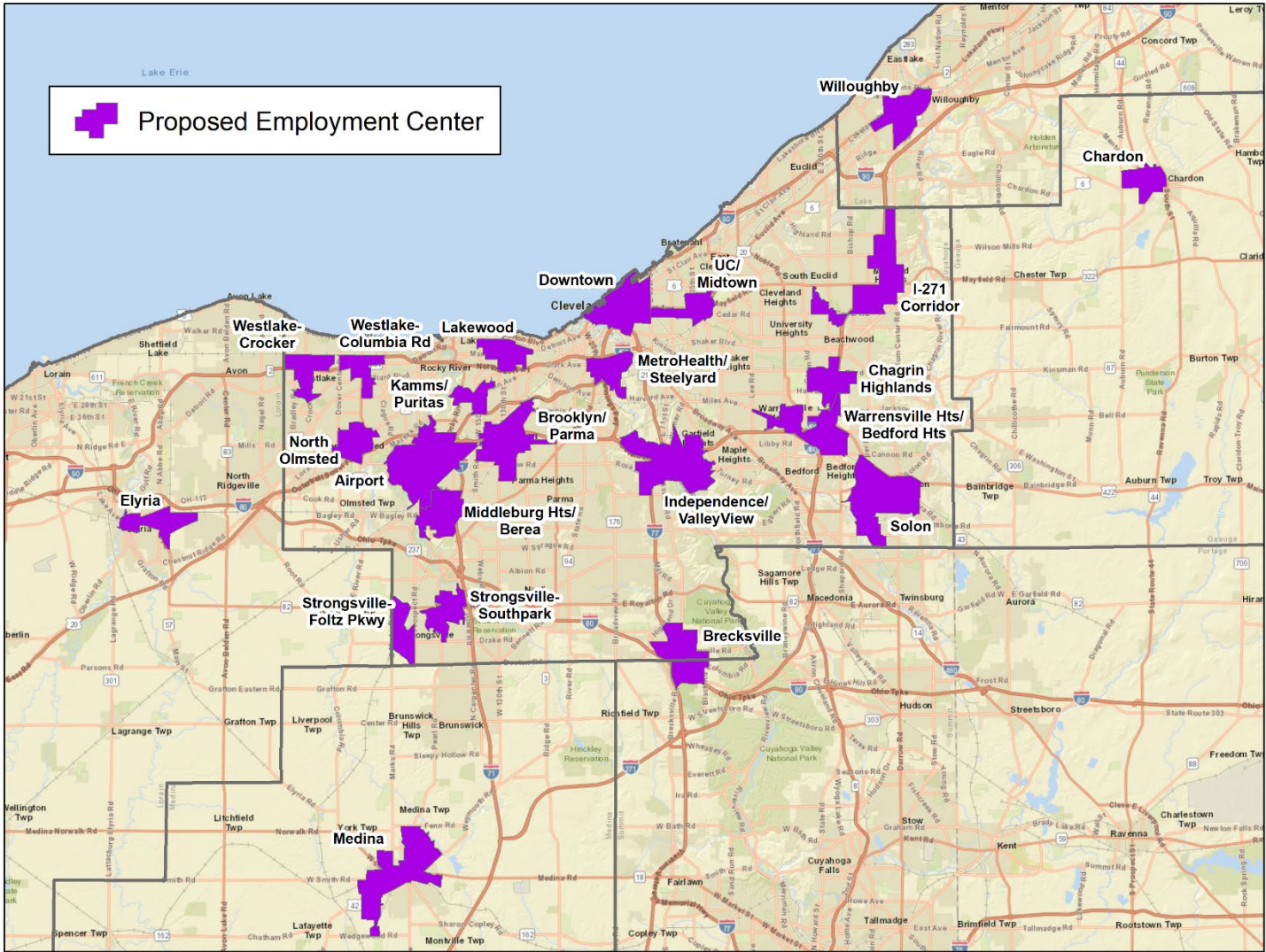
WORK TRIP DESTINATIONS



SENSITIVITY ANALYSIS



PROPOSED EMPLOYMENT AREAS FOR L2 CHARGING PORTS



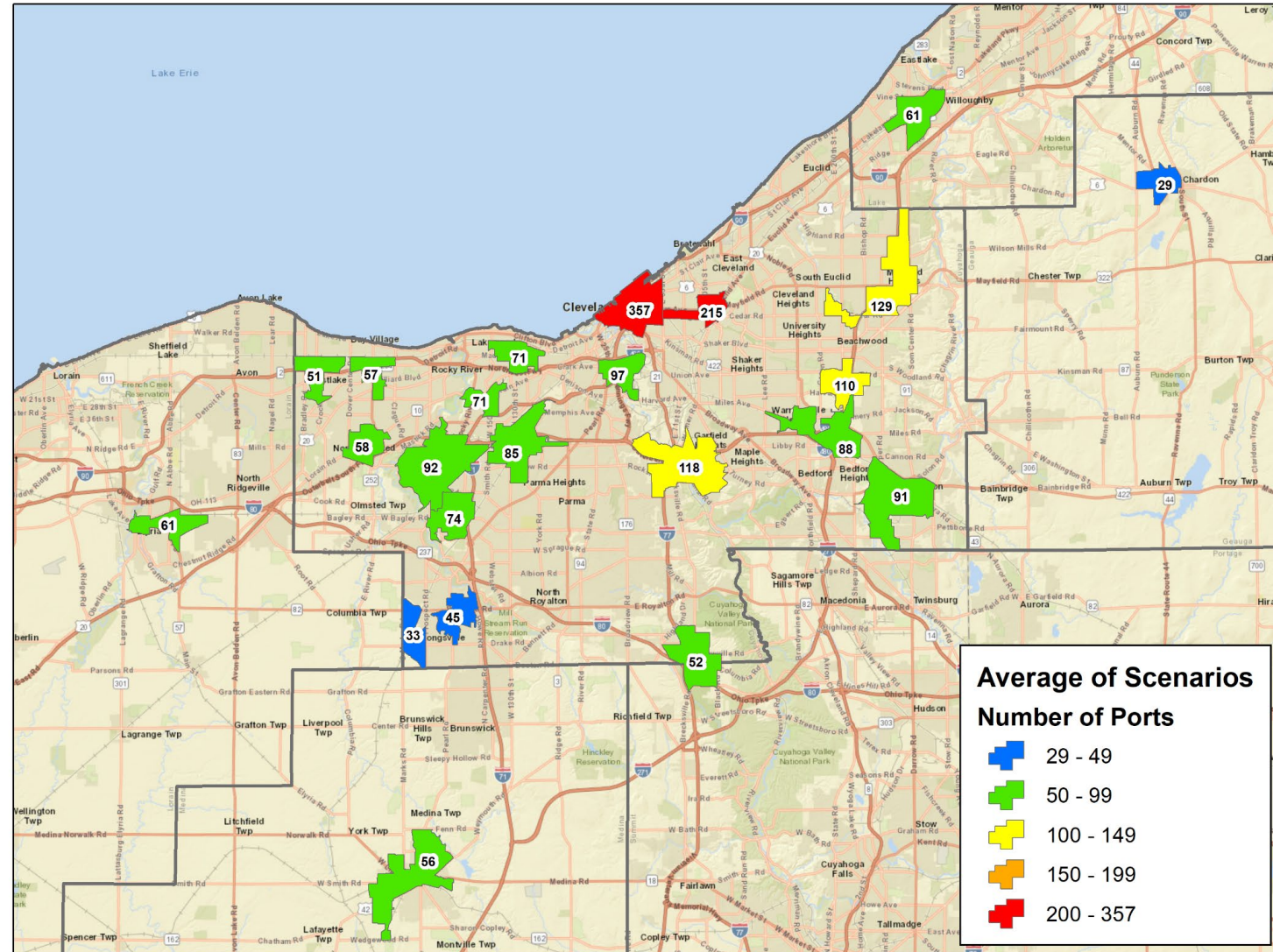
CHARGING PORT DISTRIBUTION SCENARIOS

- **TRIP DESTINATIONS**
- **EMPLOYMENT CENTER PRIORITIZATION (ECP)**
- **HYBRID**
- **INPUTS: Employment, Population, Work Trip Destinations, Road Network Capacities, Transit Service Capacities and Parking Facilities**

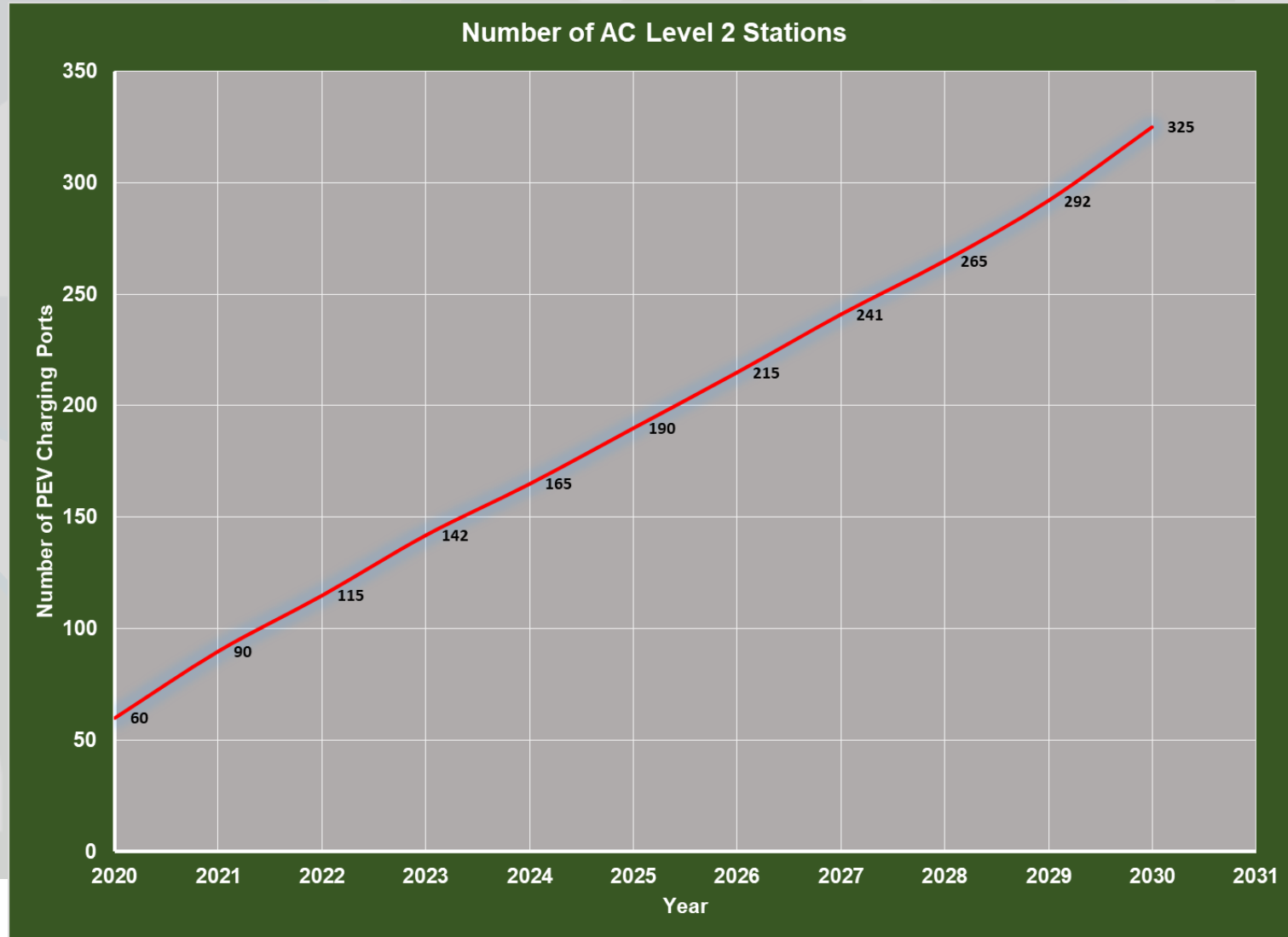
CHARGING PORT DISTRIBUTION SCENARIOS

EMPLOYMENT AREA	TRIP DESTINATION	EMPLOYMENT CENTER PRIORITIZATION	HYBRID	AVERAGE
Airport	101	126	48	92
Brecksville	55	48	54	52
Brooklyn/Parma	103	82	70	85
Chagrin Highlands	101	78	150	110
Chardon	24	20	43	29
Downtown	343	498	231	357
Elyria	62	45	76	61
I-271 Corridor	186	93	109	129
Independence/Valley View	160	111	82	118
Kamms/Puritas	46	70	98	71
Lakewood	57	73	84	71
Medina	72	41	56	56
MetroHealth/Steelyard	58	121	111	97
Middleburg Hts/Berea	76	52	92	74
North Olmsted	49	55	70	58
Solon	135	58	80	91
Strongsville-Foltz	27	18	53	33
Strongsville-Southpark	36	37	60	45
UC/Midtown	180	208	258	215
Warrensville Hts/Bedford Hts	82	118	63	88
Westlake-Columbia	41	46	84	57
Westlake-Crocker	39	37	77	51
Willoughby	66	65	52	61

PROPOSED L2 CHARGING PORT DISTRIBUTION



NUMBER OF AC LEVEL 2 STATIONS BY YEAR

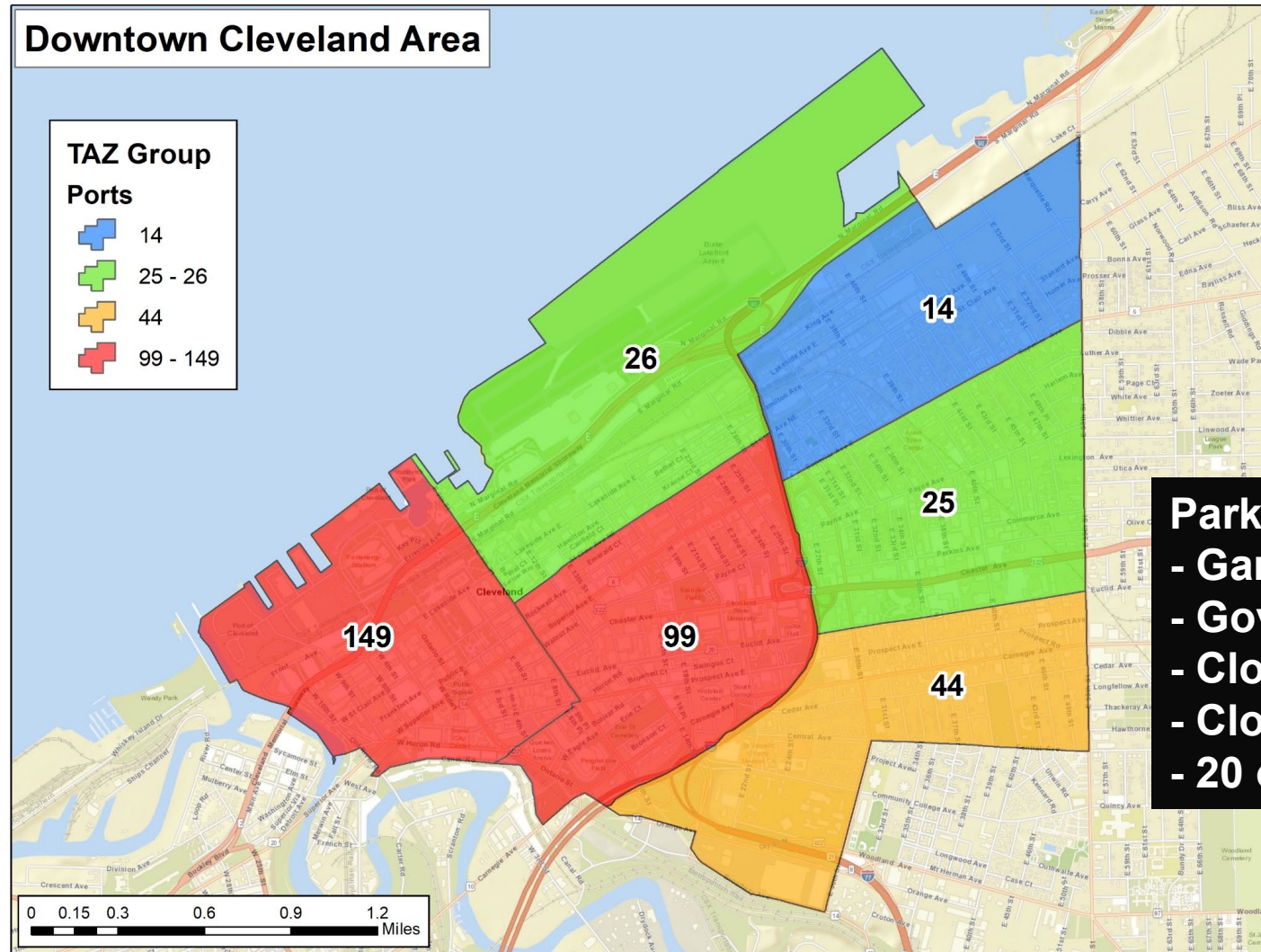


NUMBER OF AC LEVEL 2 STATIONS BY YEAR BY EMPLOYMENT

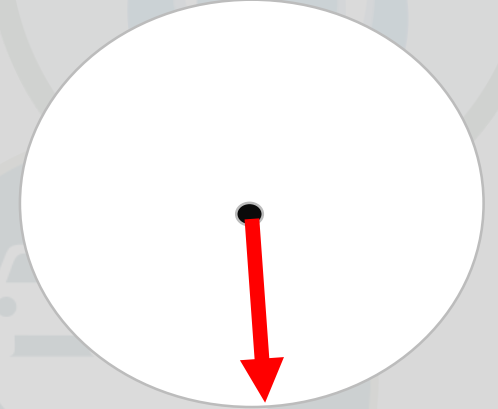
EMPLOYMENT AREA	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTAL
Airport	3	4	5	6	7	8	9	11	12	13	14	92
Brecksville	1	2	3	4	4	5	5	6	7	7	8	52
Brooklyn/Parma	2	4	5	6	7	8	9	10	11	12	13	85
Chagrin Highlands	3	5	6	7	9	10	11	13	14	15	17	110
Chardon	1	1	2	2	2	3	3	3	4	4	4	29
Downtown	10	15	20	24	28	32	37	41	45	50	55	357
Elyria	2	3	3	4	5	6	6	7	8	8	9	61
I-271 Corridor	4	6	7	9	10	12	13	15	16	18	20	129
Independence/ValleyView	3	5	6	8	9	11	12	14	15	16	18	118
Kamms/Puritas	2	3	4	5	6	6	7	8	9	10	11	71
Lakewood	2	3	4	5	6	6	7	8	9	10	11	71
Medina	2	2	3	4	4	5	6	6	7	8	9	56
MetroHealth/Steelyard	3	4	5	7	8	9	10	11	12	13	15	97
Middleburg Hts/Berea	2	3	4	5	6	7	8	8	9	10	11	74
North Olmsted	2	2	3	4	5	5	6	7	7	8	9	58
Solon	3	4	5	6	7	8	9	10	11	13	14	91
Strongsville-Foltz	1	1	2	2	3	3	3	4	4	5	5	33
Strongsville-Southpark	1	2	2	3	4	4	5	5	6	6	7	45
UC/Midtown	6	9	12	15	17	19	22	25	27	30	33	215
Warrensville Hts/Bedford Hts	3	4	5	6	7	8	9	10	11	12	14	88
Westlake-Columbia	2	2	3	4	4	5	6	7	7	8	9	57
Westlake-Crocker	1	2	3	3	4	5	5	6	6	7	8	51
Willoughby	2	3	3	4	5	6	6	7	8	8	9	61
TOTAL	60	90	115	142	165	190	215	241	265	292	325	2100

CHARGING PORT LOCATION – TAZ GROUPING

Port Allocation to A TAZ Group is Proportion to Number of Home Base Work trip ends



0.5 Mile of walking Distance (0.785 Sq. mile)

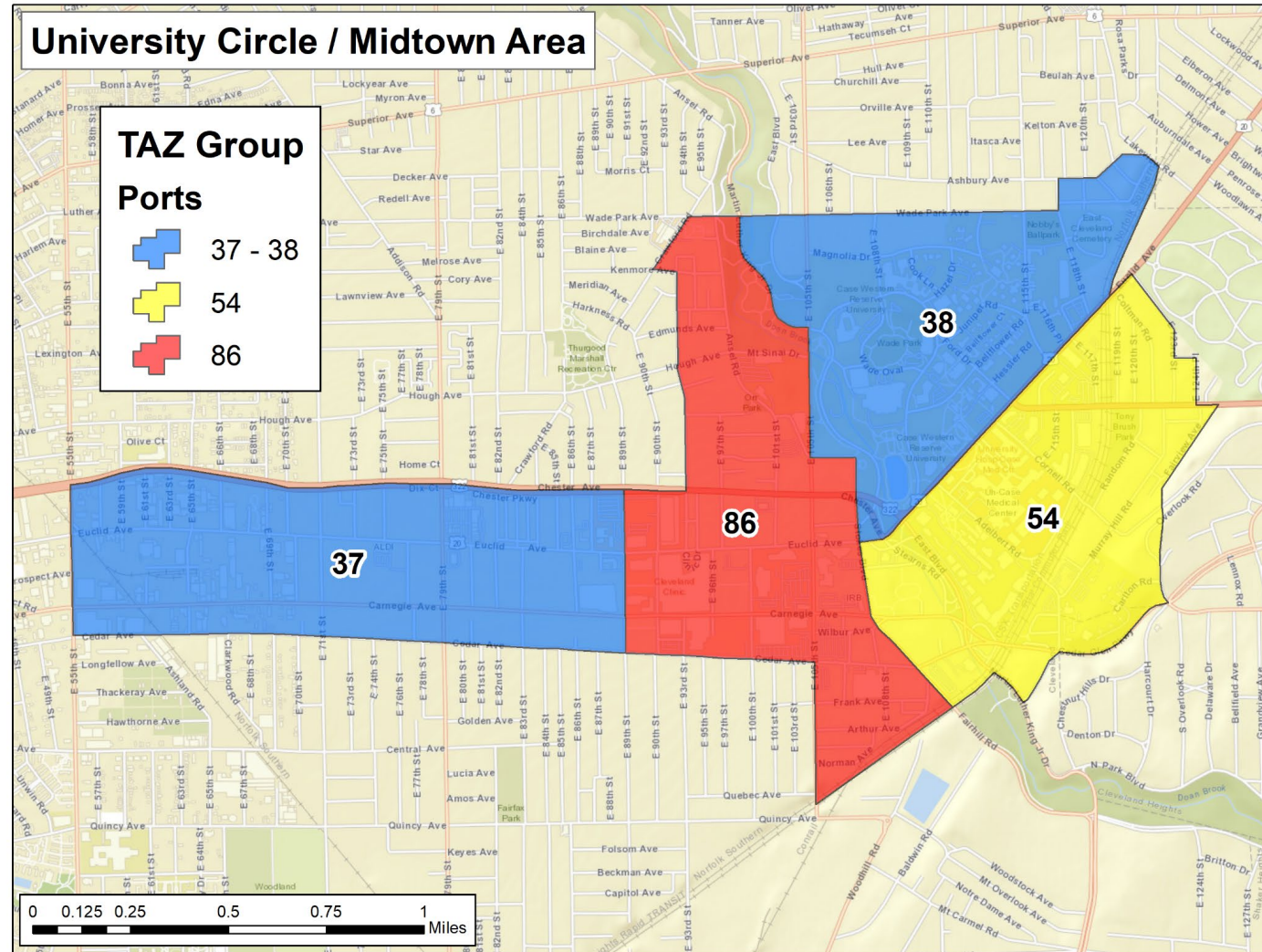


Parking Garage/Lot Selection:

- Garages
- Government Garages
- Close to employment activities
- Close to Center
- 20 or less ports per lot



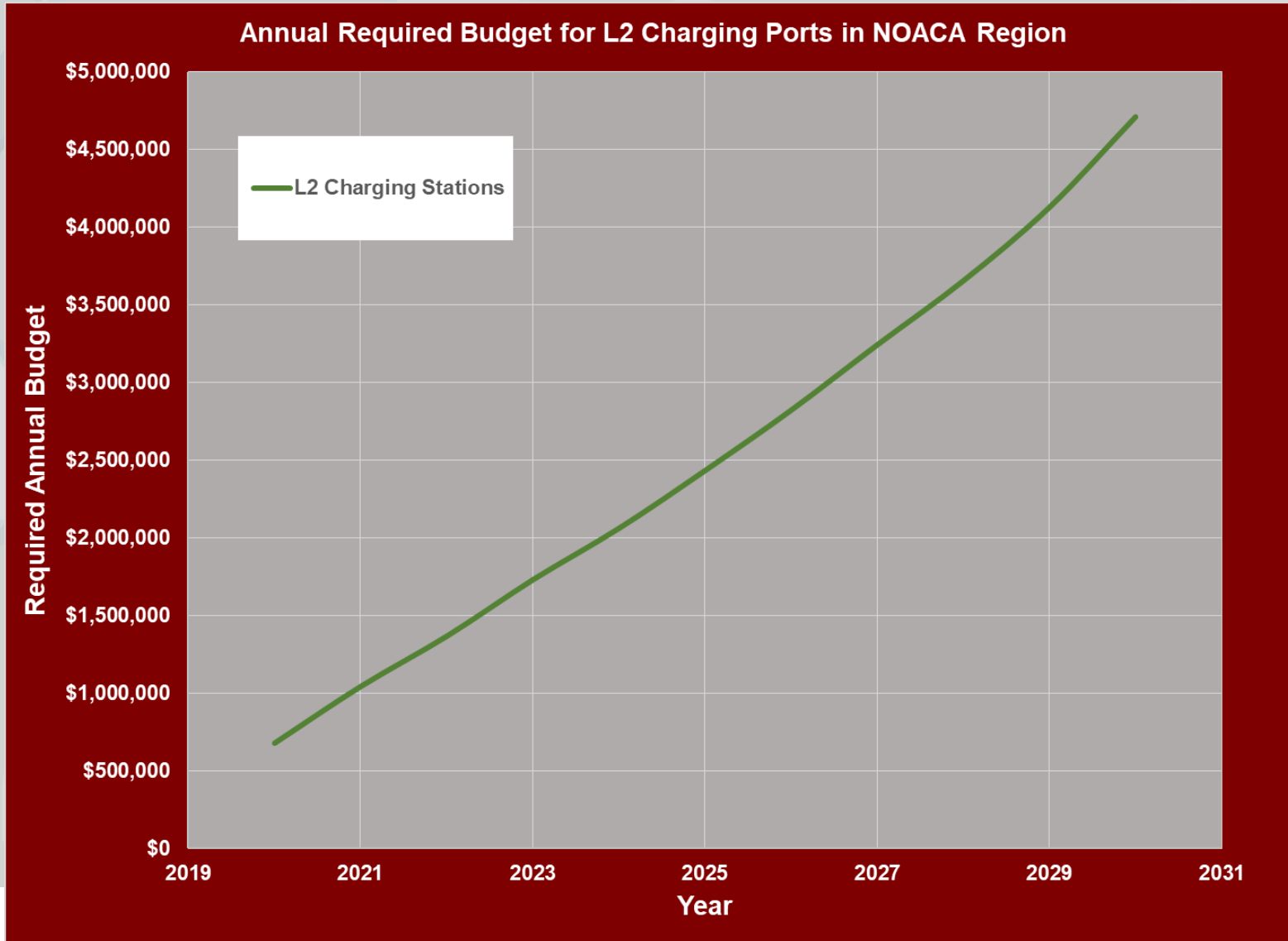
CHARGING PORT LOCATION – TAZ GROUPING



ESTIMATED EV CHARGING PORT COSTS

Electric Vehicle Supply Equipment (EVSE) Costs		
Charging Level	Unit Cost Range (2015\$)	Installation Cost Range Per Unit (2015\$)
AC Level 1	\$300 - \$1,500	\$0 - \$3,000
AC Level 2	\$400 - \$6,500	\$600 - \$12,700
DC Fast Charging (DCFC)	\$10000 - \$40,000	\$4000 - \$51,000

ANNUAL REQUIRED BUDGET BY YEAR

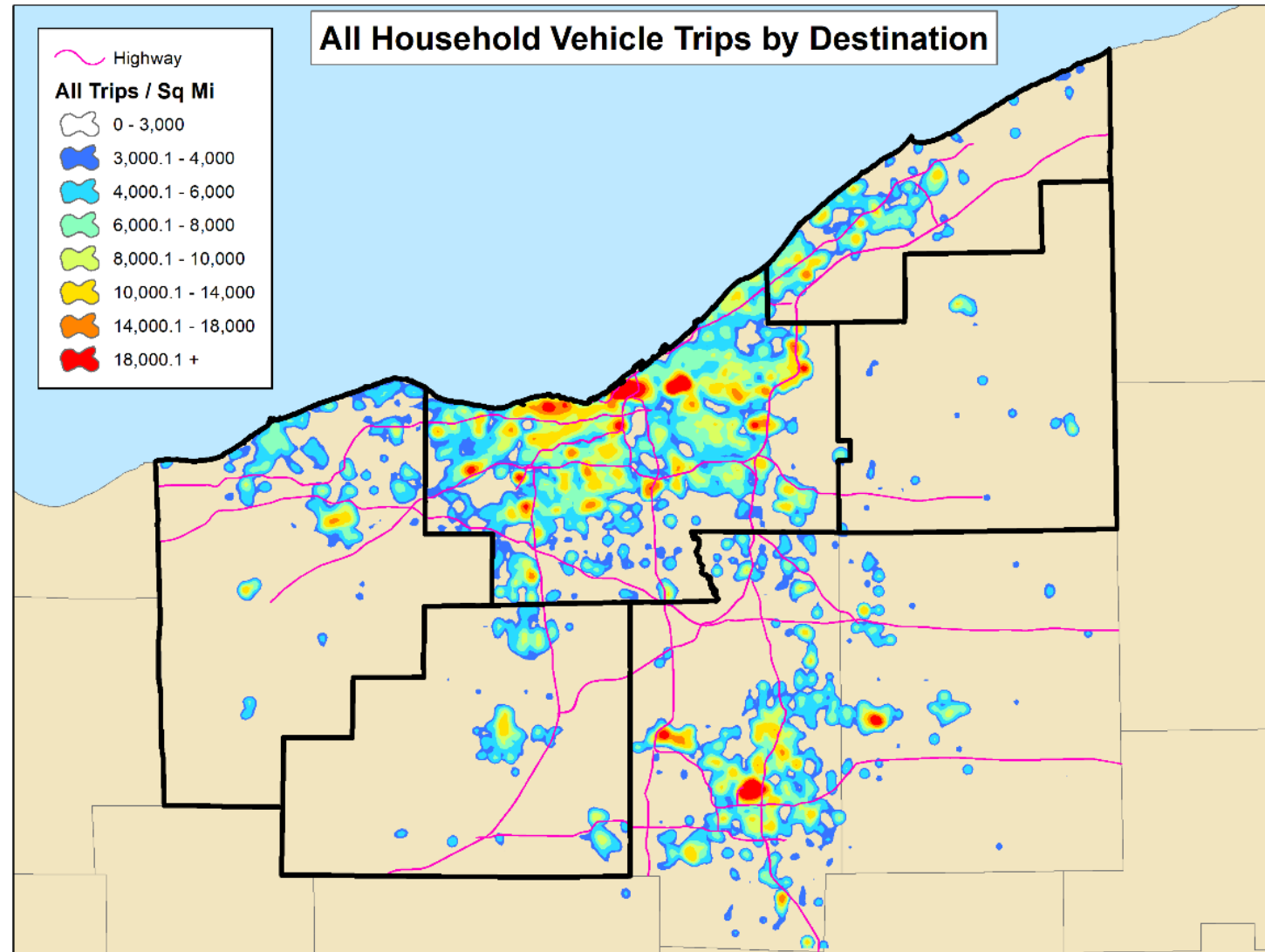


L2 REQUIRED BUDGET

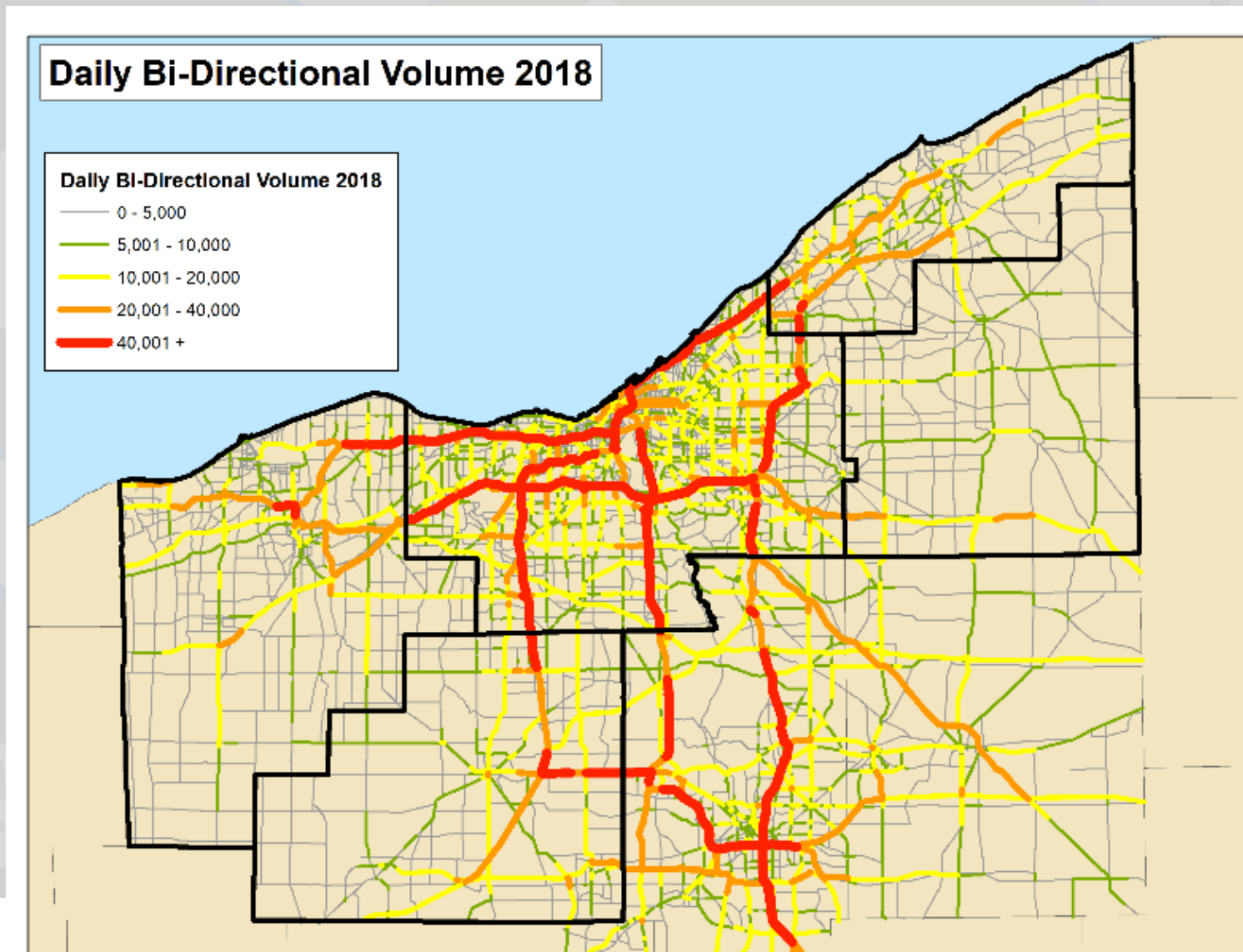
NOACA Region		
PEV and AC Level 2 Projections by 2030		
Number of PEVs	Number of Required AC Level 2 Stations at Workplace and Public	Accumulated Total Cost (Period of 2020 - 2030)
28,800	2,100	\$27.8 million

DC FAST CHARGING (DCFC) STATION LOCATIONS

ALL TRIP DESTINATIONS



TRAFFIC VOLUME MAP



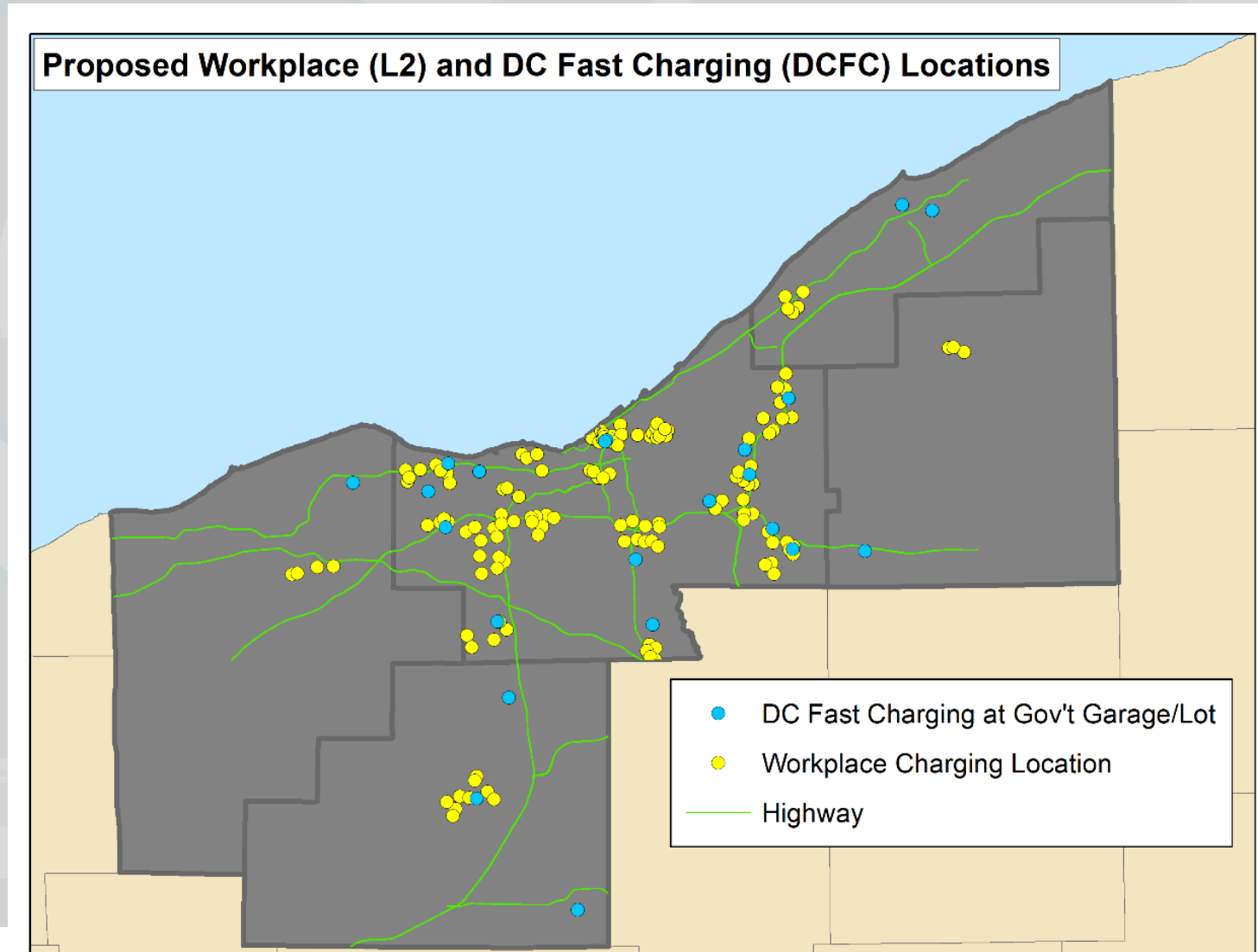
NUMBER OF DC FAST CHARGING PORTS BY PHASE

Interchange	Government Parking Garage/Lot	Phase 1 (2020 - 2025) Number of DCFC	Phase 2 (2025 - 2030) Number of DCFC	Total Number of DCFC by 2030
I-71 / Medina Rd (SR-18)	Medina Public Parking Garage	4	5	9
I-90 / Crocker Rd	Westlake Porter Library	4	6	10
I-71 / Royalton Rd (SR-82)	Strongsville Cuy. Co Library	1	2	3
I-90 / I-77 / Ontario St / E 9th St / E 14th St / E 22nd St	900 Prospect Garage / Gateway East Garage	3	4	7
I-271 / Wilson Mills Rd	Mayfield Village Park & Rec. / Civic Center	2	3	5
US-422 / SOM Center Rd (SR-91)	Solon City Hall	2	3	5
I-271 / Chagrin Rd (SR-87)	Social Security Administration	2	3	5
I-77 / Miller Rd	Brecksville Community Center	3	4	7
I-90 / Center Rd (SR-83)	U S Postal Service	1	1	2
I-271 / Cedar Rd	Beachwood Community Center	2	3	5
US-422 / Chillicothe Rd (SR-306)	Bainbridge Town Hall Complex	5	7	12
I-71 / Center Rd (SR-303)	Brunswick Library & Community Ctr	2	3	5
I-90 / Columbia Rd (SR-252)	GCRTA Westlake Park-N-Ride	2	4	6
US-422 / Harper Rd	Solon Fire Department	3	4	7
I-77 / Rockside Rd	Independence Library & Civic Ctr	3	4	7
I-90 / Detroit Rd (SR-254)	Don Umerley Civic Center	7	9	16
I-90 / SR-44	LakeTran Offices/ Lake County Adm. Building	1	1	2
I-271 / Miles Rd	Social Security Administration	1	1	2
I-480 / Great Northern Blvd	GCRTA North Olmsted Park-N-Ride	1	2	3
I-76 / High St (SR-94)	Wadsworth Public Library	1	1	2
Total		50	70	120

DCFC REQUIRED BUDGET

NOACA Region			
Phase No	Implementation Starting Year	Number of Required DCFC Stations	Total Cost
1	2020	50	\$2.94 million (2020\$)
2	2025	70	\$4.66 million (2025\$)

L2 & DCFC PROPOSED LOCATIONS



NEXT STEPS

Staff will continue to update committee regarding the Electric Vehicle Charging Station Plan and determine the potential policy implications.



NOACA will **STRENGTHEN** regional cohesion, **PRESERVE** existing infrastructure, and **BUILD** a sustainable multimodal transportation system to **SUPPORT** economic development and **ENHANCE** quality of life in Northeast Ohio.

